Armed Forces College of Medicine

AFCM

Bed side test 2
Urine sampling & Urine dipstick Testing

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Indented Learning Outcomes (ILOs)

- By the end of this lecture the student will be able to:

1. Identify steps of obtaining an adequate urine specimen in different sitiuations.
2. List different urine collection methods.
3. Describe how to perform standardized bedside dipstick urine test.
4. Interpretation of finding in urinalysis.

HOW TO OBTAIN URINE SAMPLE IN DIFFERENT SITUATIONS

- Various ways of collecting urine sample depend on the type of specimen required, the collection site and patient type.

- **Random Specimen.**
- **First Morning Specimen**
- **Midstream Clean Catch Specimen**
- **Timed Collection Specimen**
- **Catheter Collection Specimen**
- **Suprapubic Aspiration Specimen**

First Morning Specimen

- This is the specimen of choice for urinalysis and microscopic analysis, since the urine is generally more concentrated and, therefore, contains relatively higher levels of cellular elements and analytes such as protein, if present.

- It is collected when the patient first wakes up in the morning, having emptied the bladder before going to sleep.

- Note: Any urine that is voided from the bladder during the eight-hour collection period should be pooled and refrigerated, so that a true 8-hour specimen is obtained.

Random Specimen

- The most commonly specimen sent to the laboratory for analysis, the easiest to obtain and is collected at any time.
- Usually submitted for urinalysis and microscopic analysis**, although it is not the specimen of choice** for either of these tests, however it can give inaccurate results .
- Thorough instructions to patients are required to avoid the introduction of contaminants into the specimen.

Midstream Clean Catch Specimen

- The preferred type of specimen for culture and sensitivity testing because of the reduced incidence of cellular and microbial contamination.
- Patients are required to first cleanse the urethral area with a castile soap towelette. The patient should then void the first portion of the urine stream into the toilet. These first steps significantly reduce the opportunities for contaminants to enter into the urine stream. The urine midstream is then collected into a clean container.
- Can be conducted at any time of day or night.

Timed Collection Specimen

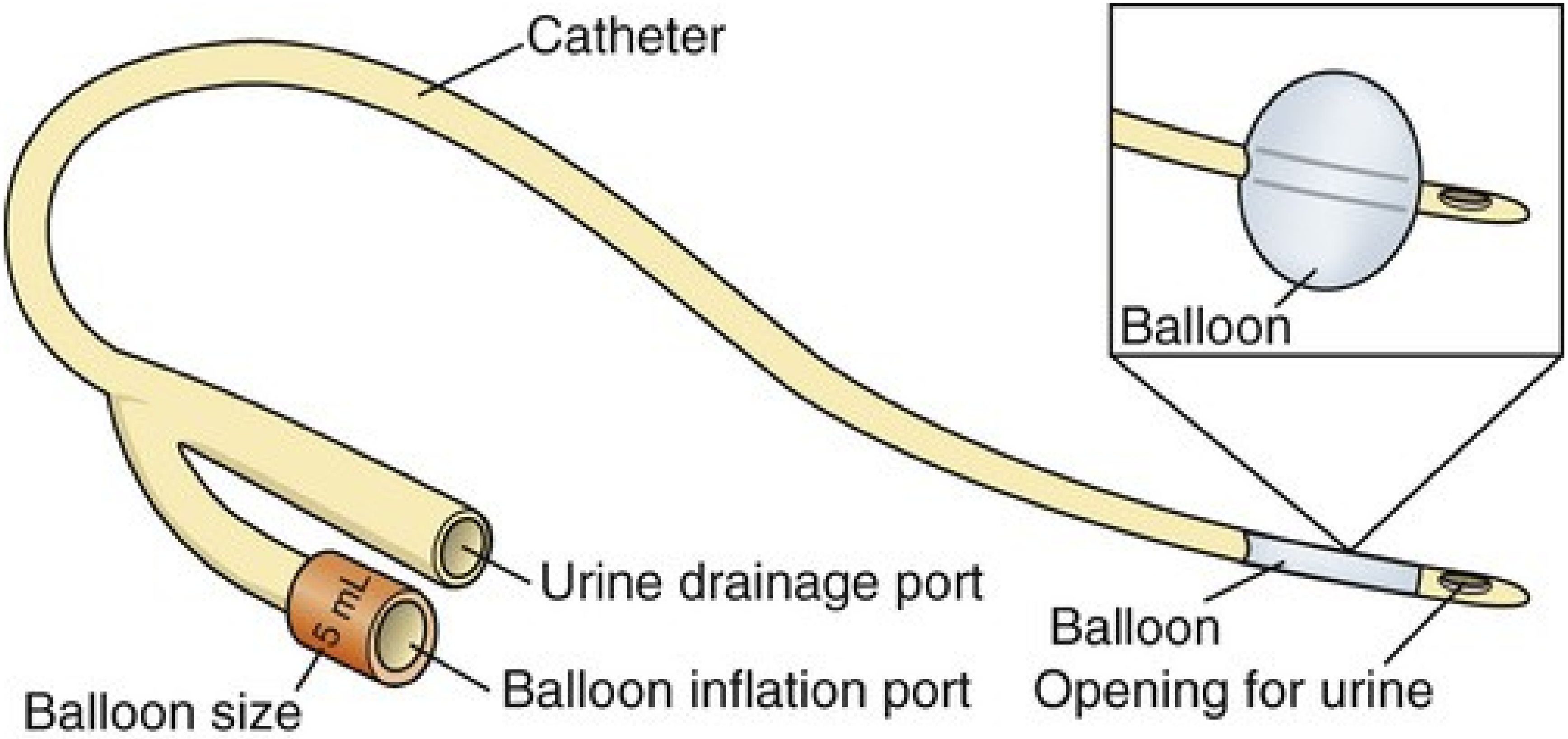
- It measures the concentration of substances that are affected by diurnal variations.
- The bladder is emptied prior to beginning the timed collection. Then, for the required duration, all urine is collected and pooled into a collection container, with the final collection taking place at the end of that period.
- The specimen should be refrigerated during the collection period, unless otherwise requested by the physician.

Patient instructions

- **Collecting a urine sample**

1. label a sterile, screw-top container with your name, date of birth and the date.
2. wash your hands.
3. start to pee
   and **collect** a **sample** of **urine**.
4. screw the lid of the container shut.
5. wash your hands thoroughly.

Catheter Collection Specimen



Catheter Collection Specimen

- Conducted when a patient is bed-ridden or cannot urinate independently.
- The healthcare provider inserts a foley catheter into the bladder through the urethra to collect the urine specimen. (Specimens may also be collected through an existing foley catheter.)
- Similarly, urine specimen could be collected from a suprapubic catheter.

Catheter Collection Specimen, Technique

- **Ensure that you have the required equipments:**
- Clean tray to hold equipment; Non-sterile gloves; Apron;
- Sterile 10ml syringe.
- Non-traumatic clamp.
- Specimen container
- Alcohol-impregnated swabs.
- Documentation and forms.

Catheter Collection Specimen, Technique

1. Decontaminate hands and prepare the equipment.
2. Explain the procedure to the patient and gain informed consent to obtain the specimen.
3. Ensure the patient is comfortable and that their privacy and dignity is maintained throughout the procedure.
4. Decontaminate your hands and put on an apron.
5. If taking a specimen from a sampling port (Fig 1a), check first whether there is urine in the catheter tube. If the tube is empty apply a clamp below the level of the sampling port (Fig 1b).

Catheter Collection Specimen, Technique

6. Decontaminate your hands and apply non-sterile gloves. Clean the sampling port with an alcohol-impregnated swab according to local policy and allow to dry (Fig 1c). This reduces the risk of cross infection or contamination of the specimen.

7. Stabilise the tubing by holding it below the level of the sampling port.

8. Insert the syringe tip into the sampling port (following manufacturer’s instructions) (Fig 1d). Be careful to protect the sterile syringe tip and disinfected sample port from contamination.

9. Aspirate at least 10ml of urine and withdraw the syringe.

10. Put the urine into a sterile universal container, (Fig 1e). Ensure the top of the specimen container is secured to prevent leakage and contamination of the specimen.

Catheter Collection Specimen, Technique

11. Wipe the sampling port with an alcohol-impregnated swab and allow to dry.

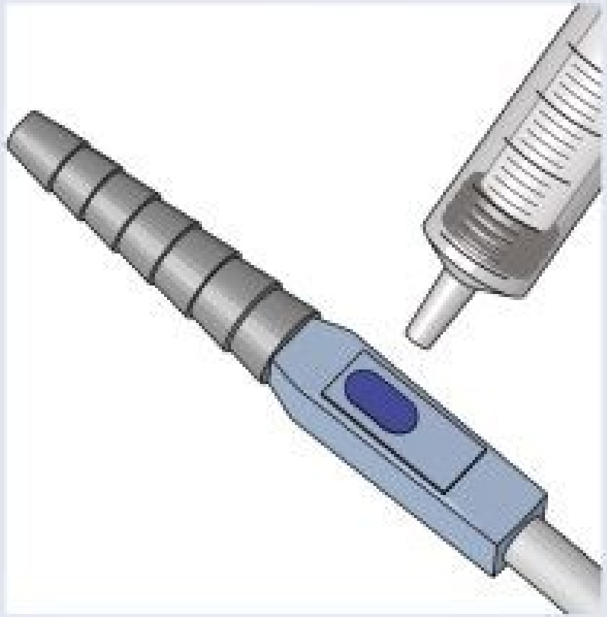
12. If a clamp was used, release it to allow urine drainage freely. Failure to do this will cause the bladder to fill and can result in discomfort and bypassing of urine around the catheter, which can be distressing for the patient.

13. Remove and dispose of gloves and apron, and wash hands with soap and water.

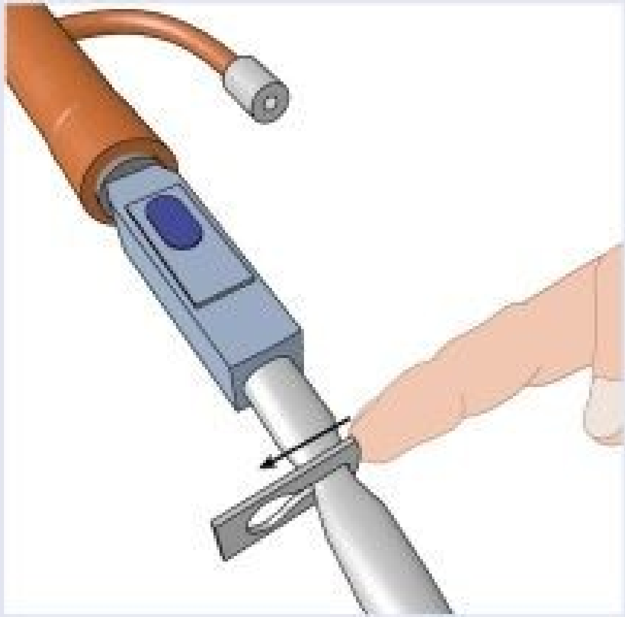
14. Complete the request form, label the specimen and place in a specimen bag following local policies.

15. Send the sample to the laboratory immediately or refrigerate until it can be transported to ensure accurate results are obtained.

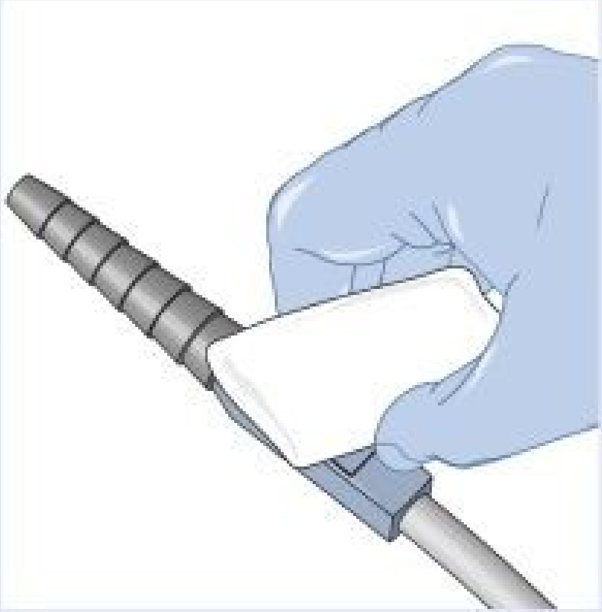
16. Document the date and time the sample was collected in the patient’s notes.



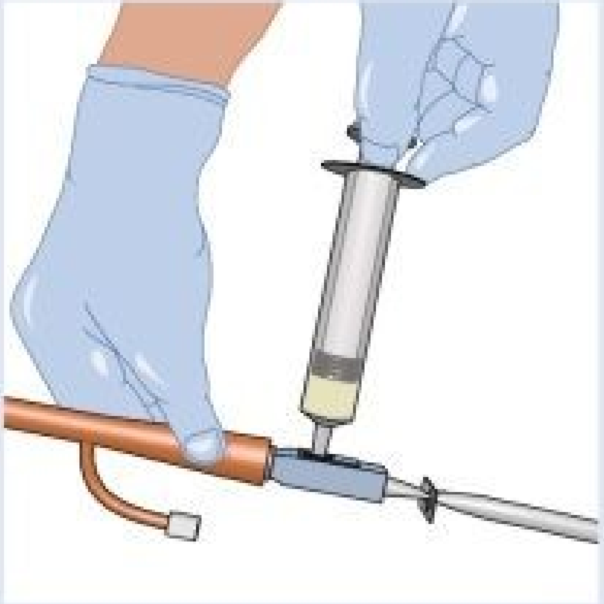
1a. A sampling port can be found on the tubing of the catheter drainage bag – urine should only be obtained from this point.



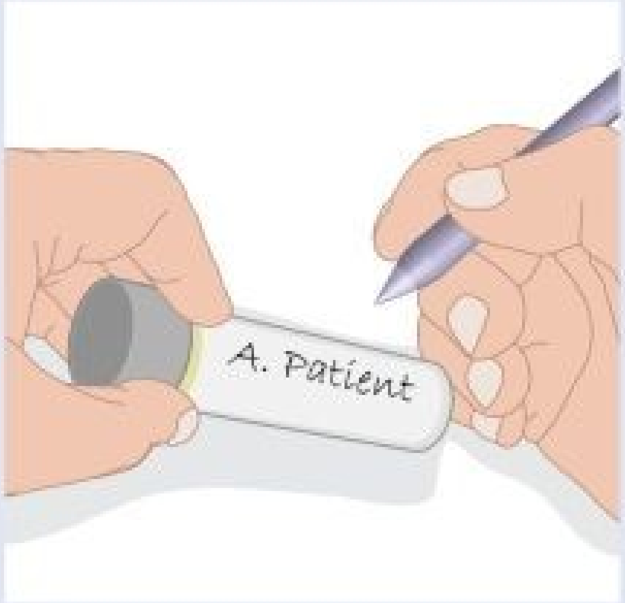
1b. Clamp the catheter below the port so that urine can collect above it in the tubing. Some catheter bags have an integral clamp.



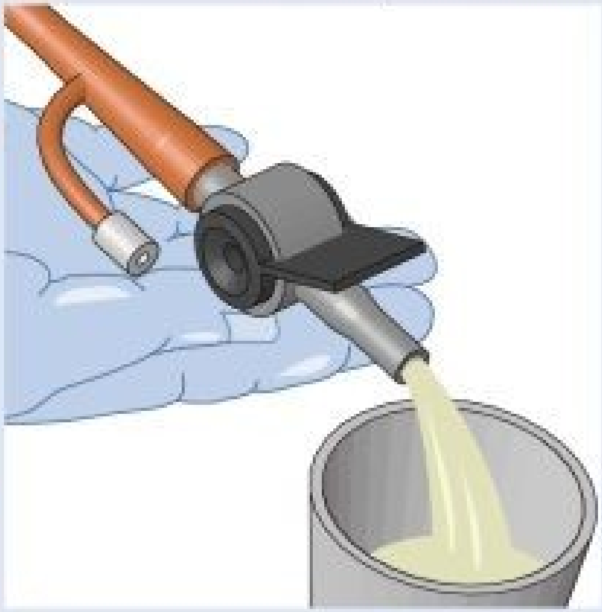
1c. Swab the sampling port with an alcohol-impregnated swab following local policy to reduce the risk of cross infection and contamination of the specimen.



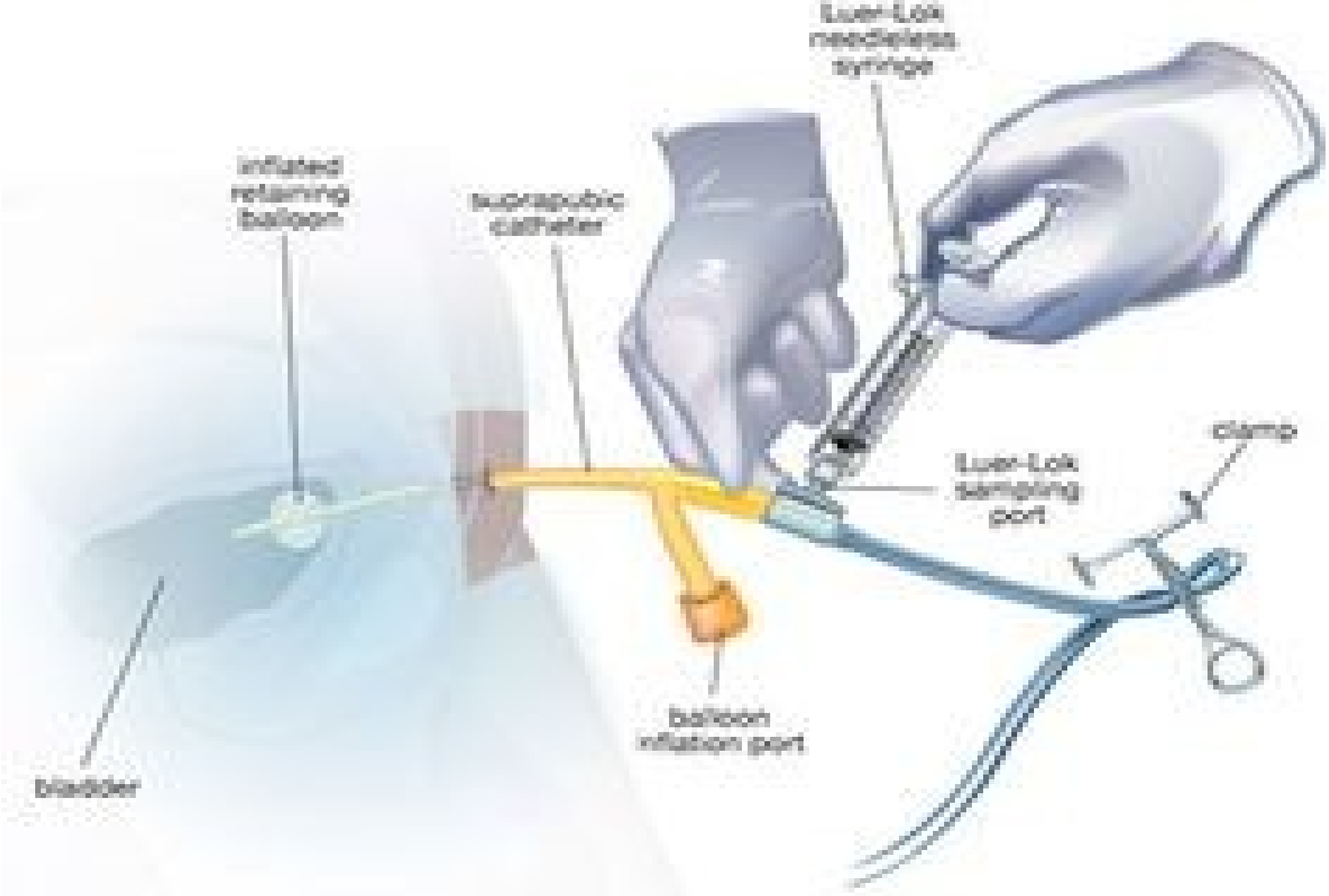
1d. Insert the syringe tip into the



1e. Place sample in the specimen pot

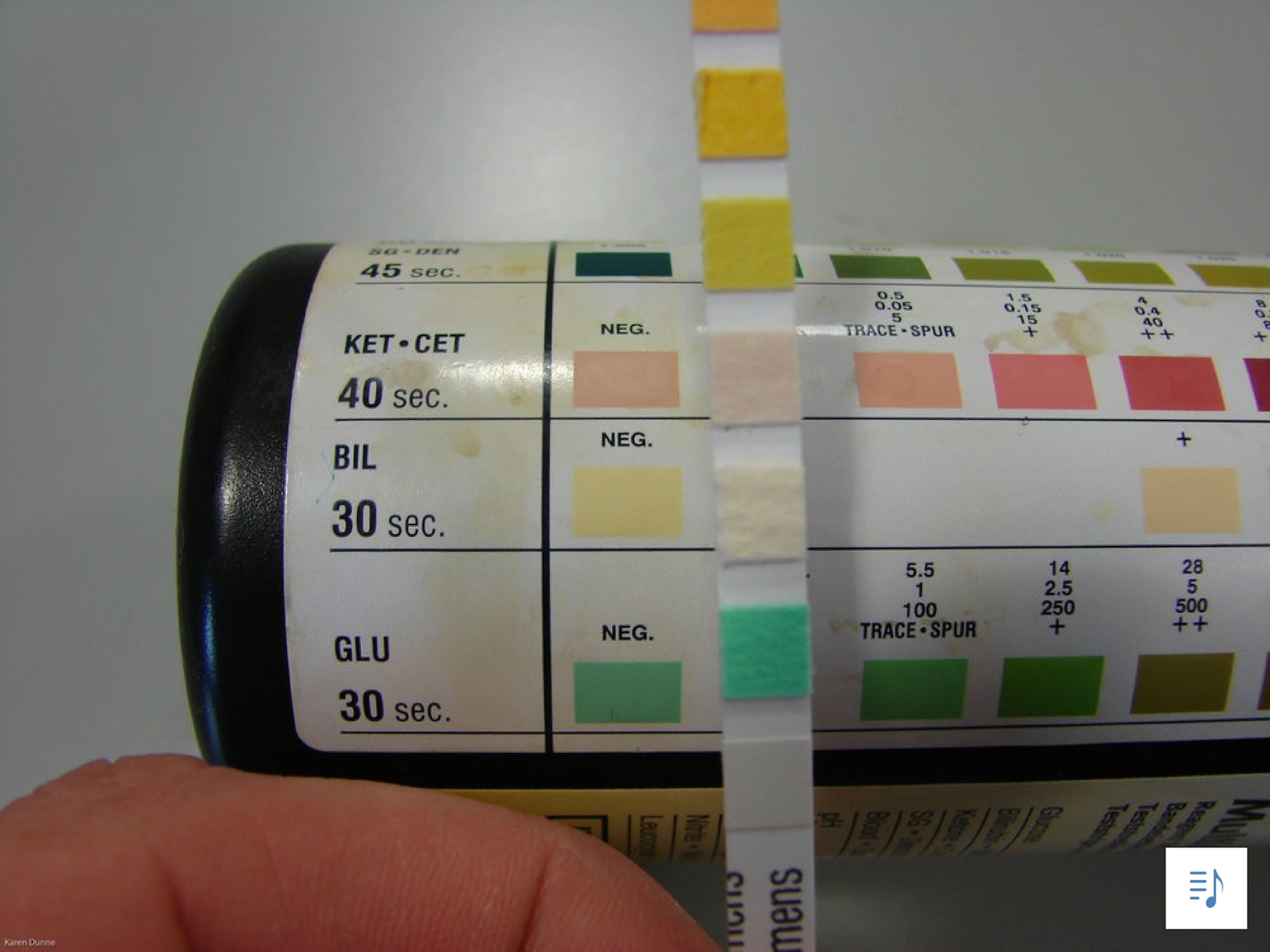


1f. If the sample is taken from a catheter


Luer-Lok needleless syringe
inflated retaining balloon
suprapubic catheter
clamp
Luer-Lok sampling port
balloon inflation port
bladder

Video illustration of indwelling catheter sampling

URINE DIPSTICK TESTING


SG • DEN
45 sec.
KET • CET
40 sec.
NEG.
0.5
0.05
5
TRACE • SPUR
1.5
0.15
15
+
4
0.4
40
++
BIL
30 sec.
NEG.
+
GLU
30 sec.
NEG.
5.5
1
100
TRACE • SPUR
14
2.5
250
+
28
5
500
++
pH
Blood
SG
Ketone
Bilirubin
Glucose
mens

Karen Dunne

Urine Dipstick

- A **urine test strip** or **dipstick** is a basic diagnostic tool used to determine pathological changes in a patient’s urine in standard urine analysis.

- The test can often be read in as little as 60 to 120 seconds after dipping, although certain tests require longer.

Urine Dipstick

- Standard urine test strip may comprise up to 10 different chemical pads or reagents which react (change colour) when immersed in, and then removed from, a urine sample.
- It can test for the presence of proteins, glucose, ketones, haemoglobin, bilirubin, urobilinogen, acetone, nitrite and leucocyte esterase as well as testing of pH and specific gravity.

Urine Dipstick

- Qualitative strips determine if the sample is positive or negative.

- On the other hand, semi-quantitative provide also an estimation of a quantitative result depending on the depth of the colour. Semi-quantitative values are usually reported as: trace, 1+, 2+, 3+ and 4+;

Urine Dipstick

- The reading of the results is carried out by comparing the pad colours with a colour scale provided by the manufacturer, no additional equipment is needed

Urine Dipstick

- An improper technique can produce false results:

➢ Leukocytes and erythrocytes precipitate at the bottom of the container and may not be detected if the sample is not properly mixed.

➢ Excess urine on the strip after removal from the test sample, may cause the reagents to leak from the pads onto adjacent pads resulting in mixing and distortion of the colours.

Urine Dipstick, Technique

- **Ensure that you have the required equipment's:**
- Alcohol gel
- Gloves
- Apron
- Dipsticks
- Urine sample
- Paper towels

Urine Dipstick, Technique

- **1.** Wash your hands.
- **2.** Wear an apron and gloves.
- **3.** Confirm the patient’s details on the sample bottle are correct.
- **4.** Check the expiry date of the urinalysis dipstick.
- **5.** Remove a dipstick from the container whilst avoiding touching the reagent squares.

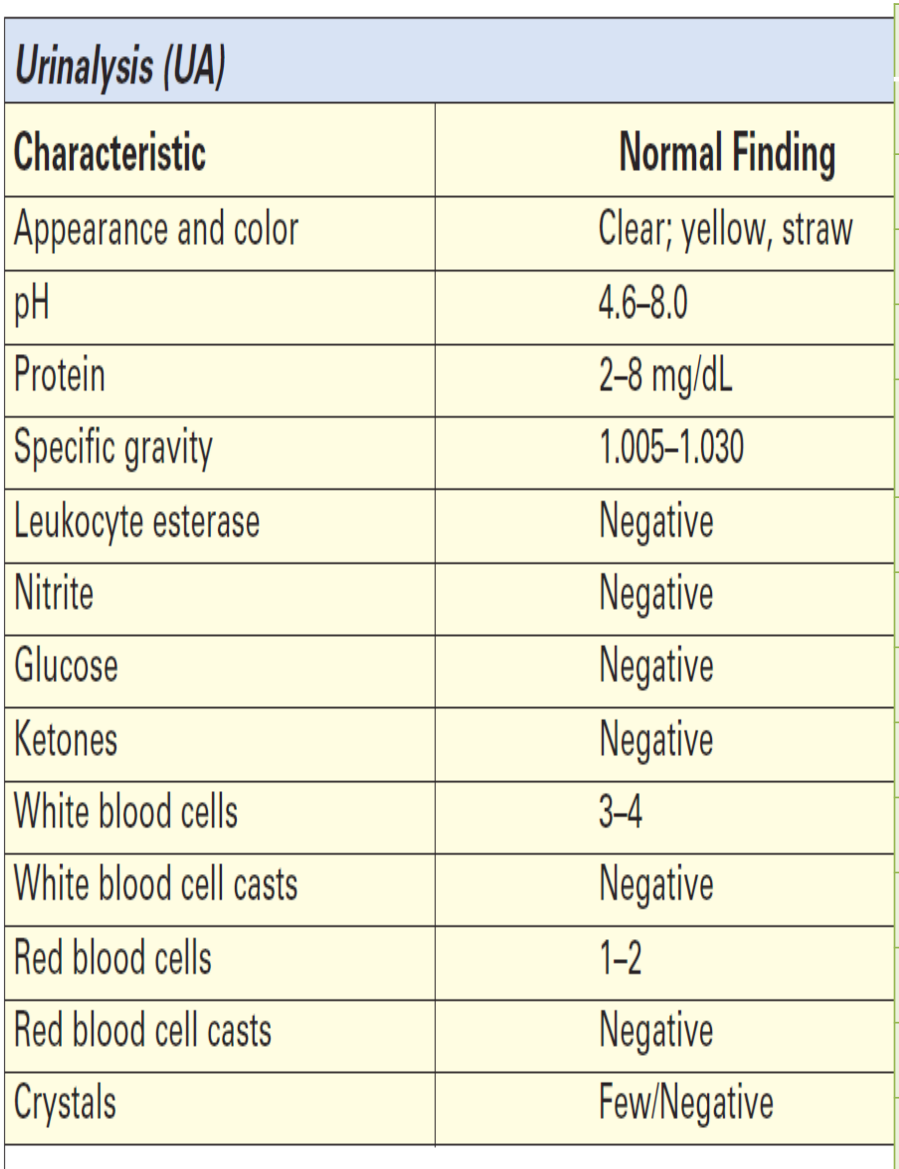
Urine Dipstick, Technique

- **6.** Replace the container lid to prevent oxidization of the remaining dipsticks.
- 7.Insert the dipstick into the urine sample, ensuring all reagent squares are fully immersed.
- **8.** Remove the dipstick immediately and tap off any residual urine using the edge of the container, making sure to hold the dipstick horizontally to avoid cross-contamination of the reagent squares.
- **9.** Lay the dipstick flat on a paper towel.

- **10.** Use the urinalysis guide on the side of the testing strip container to interpret the findings. Different reagent squares on the strip need to be interpreted at different times, so ensure you interpret the correct test at the appropriate time interval (e.g. 60 seconds for protein).
- **11.** Once you have interpreted all of the tests, discard the strip into the clinical waste bin along with your gloves and apron.
- **12.** Wash your hands.

Video illustration of Urinary Dipstick Test

Interpretation of results



Urinalysis (UA)	
Characteristic	**Normal Finding**
Appearance and color	Clear; yellow, straw
pH	4.6–8.0
Protein	2–8 mg/dL
Specific gravity	1.005–1.030
Leukocyte esterase	Negative
Nitrite	Negative
Glucose	Negative
Ketones	Negative
White blood cells	3–4
White blood cell casts	Negative
Red blood cells	1–2
Red blood cell casts	Negative
Crystals	Few/Negative

Abnormal urine
Abnormal significance
Turbid, white, red.
+++ proteinuria.
Low in diluted urine high in concentrated urine
++ means UTI
++ means UTI
++ in DM
++ in KDA or starvarion
>5/HPF=pyuria .
+ =UTI
> 3-5 = hematuria
++ glomerulonephritis
++ crystaluria

Urine volume

- Oliguria **100-400 ml/24h**.
- anuria **(< 50 ml/24h**
- Causes:
  - Shock.
  - Complete bilateral urinary tract obstruction.
  - Renal cortical, tubular necrosis.
  - Bilateral vascular occlusion (as with a dissecting aneurysm.

Polyuria urine output > 4 L /24h

Causes:

DM

Compulsive water intake.

Diabetes insipidus.

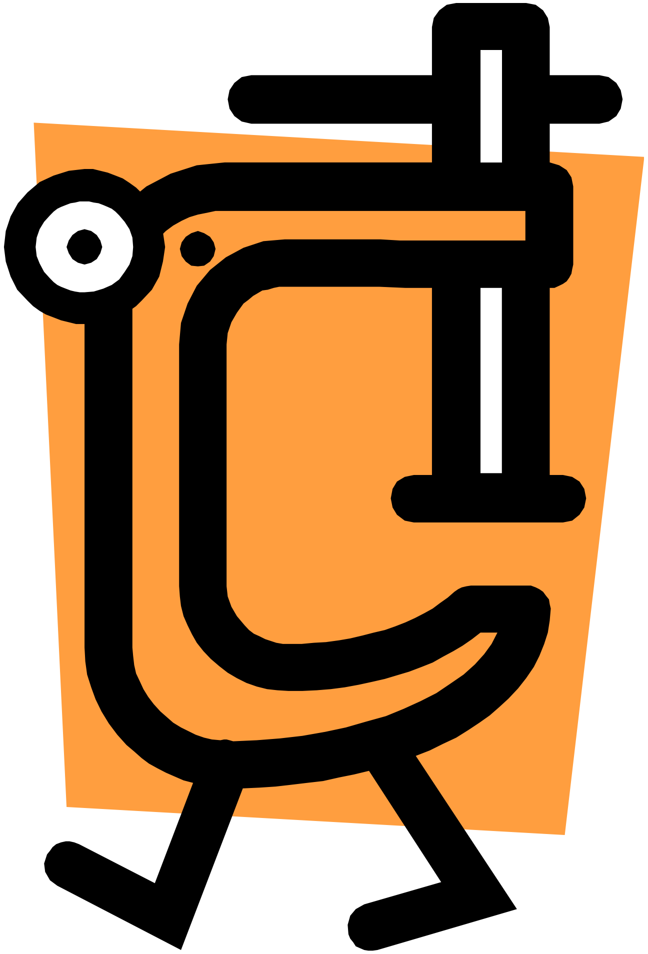
Abnormal urine color

- Normal colour: Amber yellow
- White:
  - pyuria or phosphate crystals.
- Red or brown:
  - Heamaturia, myoglobulinuria, hemoglbuinuria, drug.

Microscopic examination

In a normal patient,

- White blood cells: 0 - 4 /HPF.
- Red blood cells: 0 to 2 /HPF.
- Cast : 1/ 10 - 20 LPF.
- Crystals of uric acid, calcium oxalate, or phosphate may occasionally be seen.



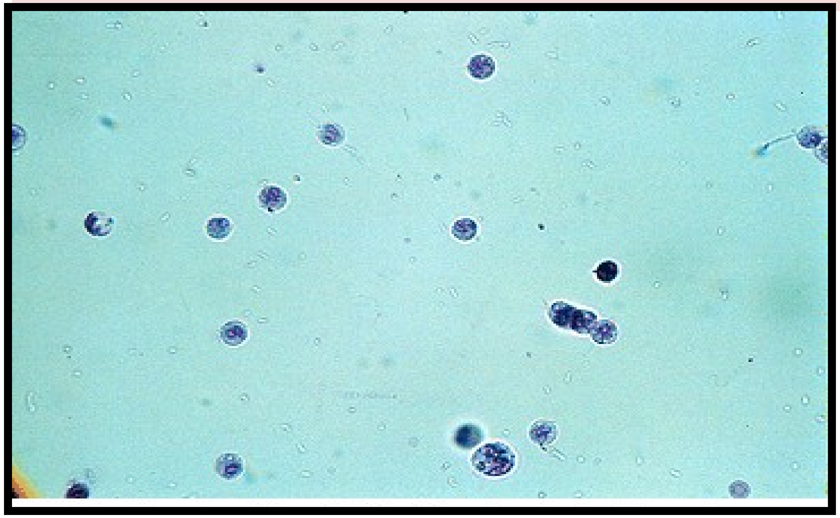
DD of cells

Pyuria (>5 WBCs /HPF)

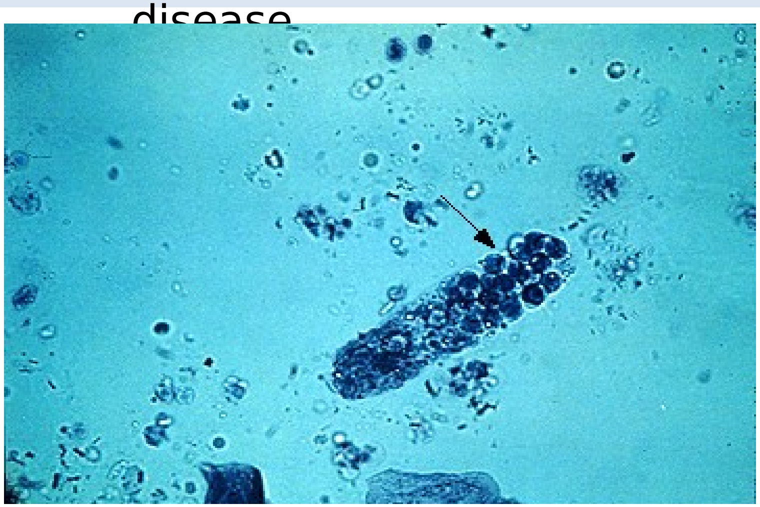
DD: Urinary tract infection.

Urine culture and sensitivity organism.

- Sterile pyuria:
  - Tubulo-interstail nephritis.
  - Urinary tract tuberculosis.

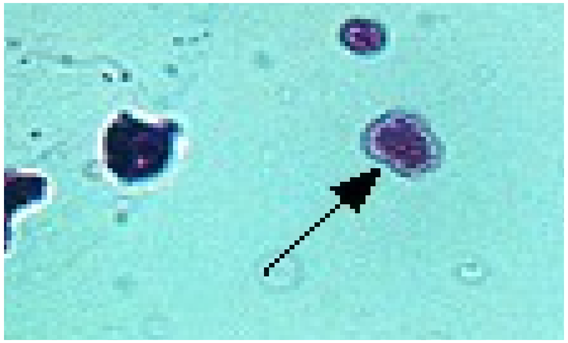


- Eosinophils and lymphocytes can be identified by a Wright's stain of the sediment
- **Eosinophiluria:**
  - Acute interstitial nephritis, (but the diagnostic accuracy of urinary eosinophils is uncertain).
- **Urinary lymphocytes**
  - Chronic tubulointerstitial disease

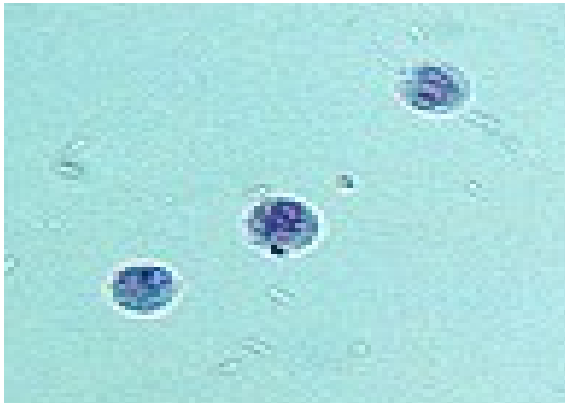


Epithelial cells

- It is shed from anywhere within the genitourinary tract.
- Renal tubular cells are diagnostically significant.
  - Renal tubular cells are 1.5 to 3 times larger than white cells and contain a round, large nucleus.



Epithelial cells



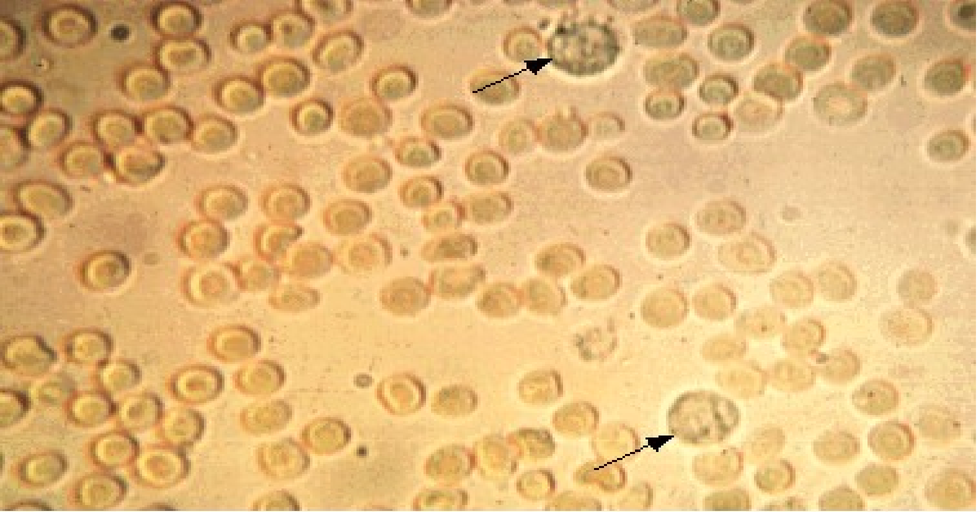
WBCs

Hematuria >3RBCs /HPF

- 1 to 2 RBCs /HPF and are therefore at least as sensitive as urine sediment examination.
- Microscopic hematuria should be confirmed by repeat testing and urine microscopy.
- False positive tests hemoglobinuria myoglobuniria).

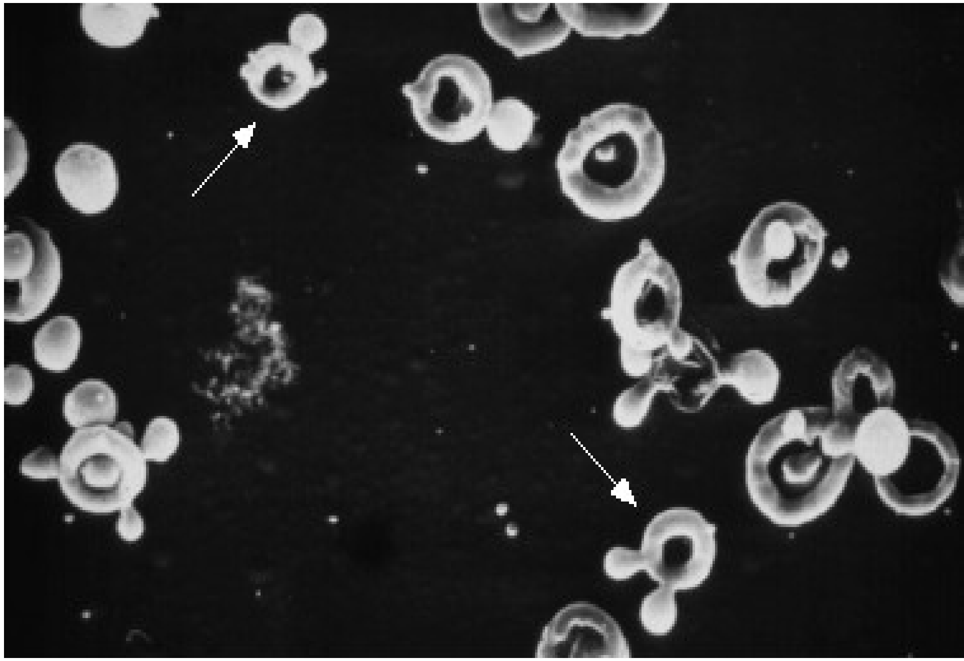
Extraglomerular vs glomerular heamaturia

	Extraglomerular	**glomerular**
Color of urine	Red or pink	Red or cocacola
clots	May be +ve	absent
proteinuria	<500 mg /dl	May be > 500mg/dl
RBCs morphology	isomorphic	dysmorphic
Red cell cast	absent	May be present



Isomorphic RBCs

RBCs Cast

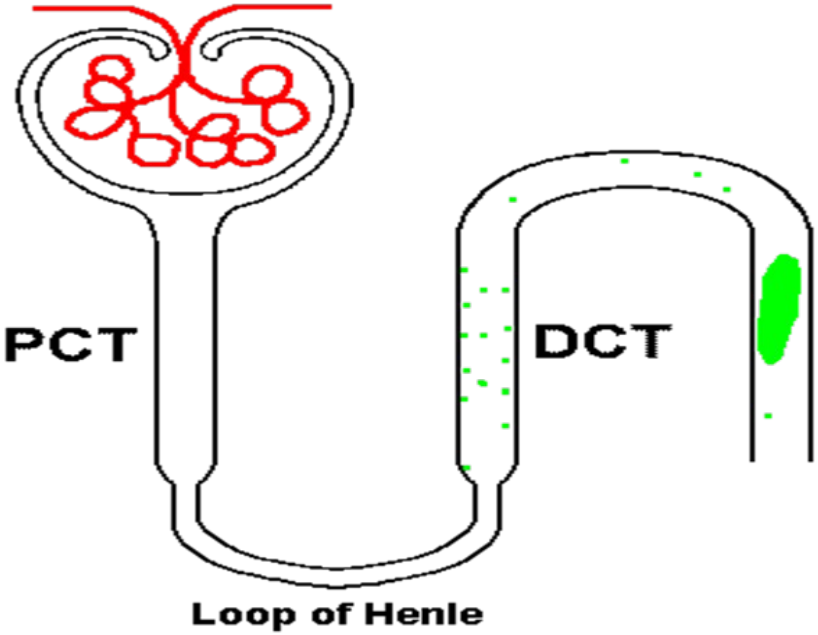


Dysmorphic red cells
contrast phase microscopy

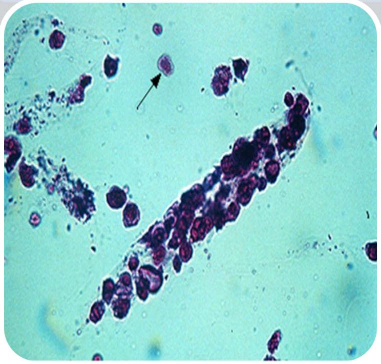
Dysmorphic red cells
scanning microscopy

Cast

- **Hyaline Casts =** can be seen even in healthy subjects
- **RBCs casts =** glomerulonephritis
- **Granular casts =** CKD
- WBCs casts = acute pyelonephritis



DD of cast

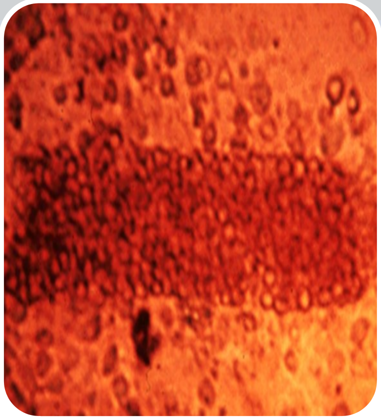


Epithelial cells casts

Acute tubular ,necrosis

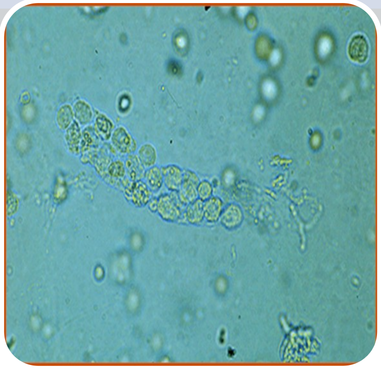
.Pyelonephritis

.Nephrotic syndrome



Red cell casts

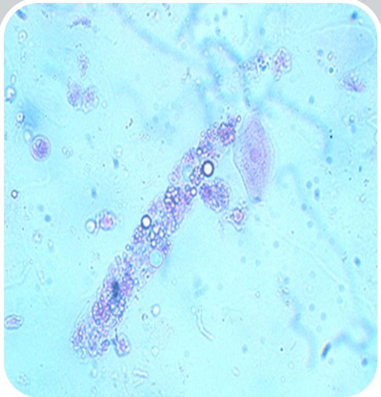
glomerulonephritis or vasculitis



White cell + casts

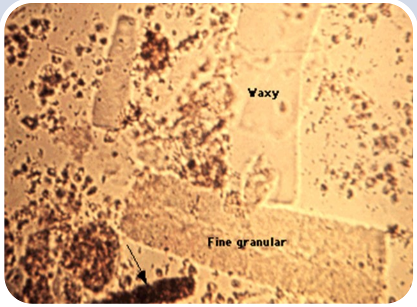
pyuria tubulointerstitial disease

acute .pyelonephritis

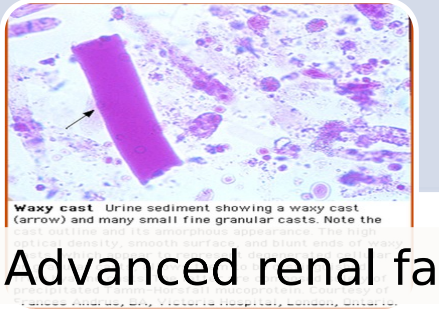


Fatty cast

proteinuria



Granular cast



Waxy cast Urine sediment showing a waxy cast (arrow) and many small fine granular casts. Note the cast outline and its amorphous appearance. The high optical density, smooth surface, and blunt ends of waxy casts which appear to represent degenerated cellular [illegible] precipitated Tamm-Horsfall mucoprotein. Courtesy of Frances Andrus, BA, Victoria Hospital, London, Ontario.

Advanced renal failure

Waxy cast

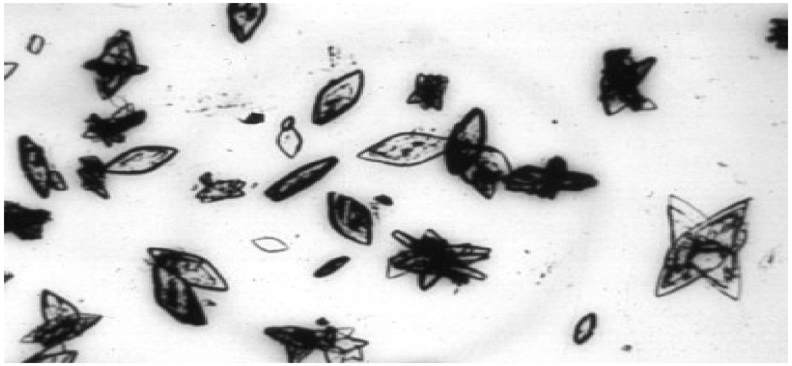
Broad cast

Crystals

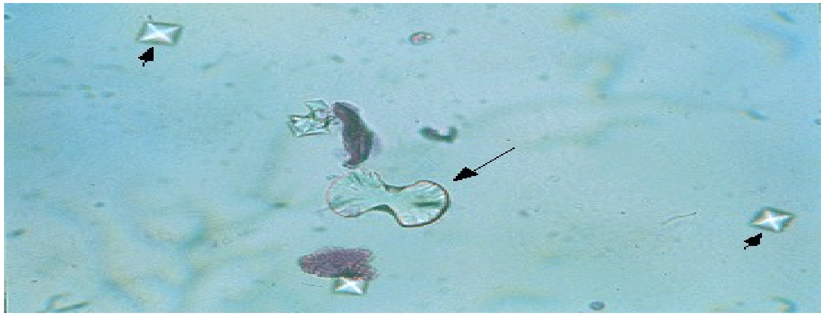
Crystals in the urine depends upon:

- The degree of supersaturation of constituent molecules.
- Urine pH.
- The presence of inhibitors of crystallization.

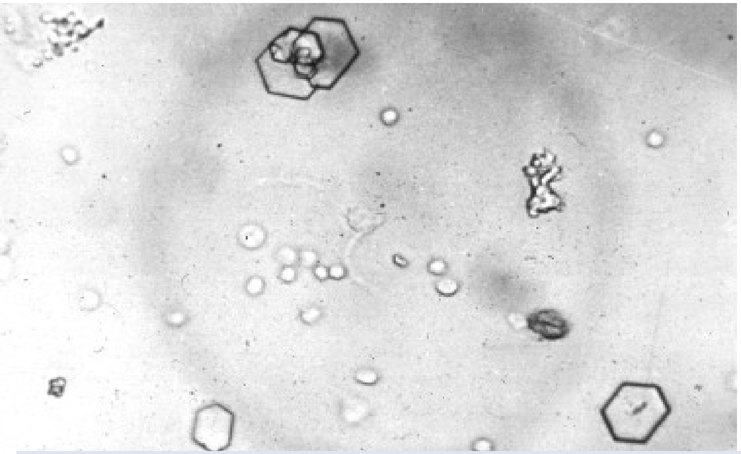
DD of crystals



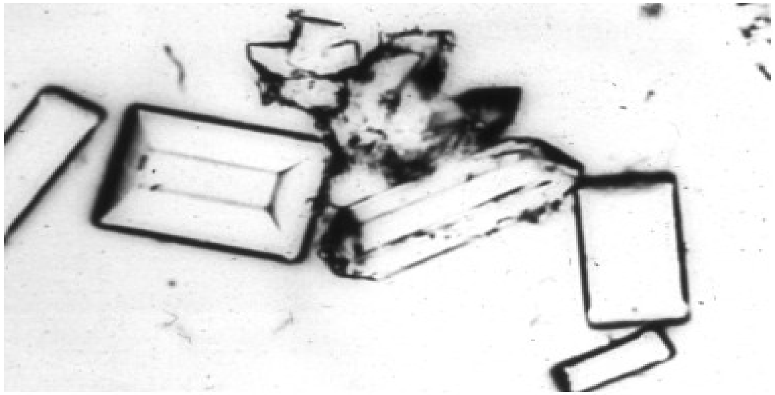
Uric acid crystals Urine sediment loaded with uric acid crystals. These crystals are pleomorphic, most often appearing as rhombic plates or rosettes. They are yellow or reddish-brown and form only in an acid urine. Courtesy of Harvard Medical School.



Calcium oxalate crystals Urine sediment showing both dumbbell-shaped calcium oxalate monohydrate (long arrow) and envelope-shaped calcium oxalate dihydrate (short arrows) crystals. Although not shown, the monohydrate crystals may also have a needle-shaped appearance. The formation of calcium oxalate crystals is independent of the urine pH. Courtesy of Frances Andrus, BA, Victoria Hospital, London, Ontario.



hexagonal shape, are diagnostic of cystinuria



Phosphate crystals Urine sediment showing multiple "coffin lid" magnesium ammonium phosphate crystals which form only in an alkaline urine (pH usually above 7.0). Courtesy of Harvard Medical School.

Quantitative urinary protein excretion

- Normal urinary protein excretion should be less than 150 mg per day.
- Normal urinary albumin less than 30 mg/24h.

Measurement of quantitative urinary protein excretion

i. 24h urine collection is the gold standard for detection of proteinuria or micro-albuminuria, allow simultanous measurement of Creatinine clearance. however, collecting these specimens may be cumbersome in ambulatory care settings.

ii. Total protein-to-creatinine ratio (mg/mg).

iii. Urinary albumin to urinary creatinine ratio in random spot collection.

iv. Timed urine collection (over 4 h or overnight).

Normal Urine Analysis

Chemical examination:

Alb: Nil
Sugar: Nil
Acetone: Nil
Bile pigments: Nil
Urobi1inogin: Normal trace

Microscopic examination:

Epithelial cells: Nil
Pus cells: 0-4 /HPF
RBGs: 0-2 /HPF
Crysta1s: Nil
Casts: Nil

Physical examination:

Volume: 200 cc. (random sample)
Co lour: Amber Yellow
Reaction: Acidic
Specific gravity: 1025
Aspect: turbid

Chemical examination:

Alb: ++
Sugar: Nil
Acetone: Ni1
Bile pigments: Nil
Urobi1inogin: Normal trace

Microscopic examination:

Epithelial cells: + +
Pus cells: > 100 /HJ'F
RBGs: 2-3 /HPF
Crysta1s: Nil
Casts: Nil

Urinary tract infection

Physical examination:

Volume: 200 cc. (random sample)
Co lour: Amber Yellow
Reaction: Acidic
Specific gravity: 1025
Aspect: turbid

Chemical examination:

Alb: ++
Sugar: Nil
Acetone: Ni1
Bile pigments: Nil
Urobi1inogin: Normal trace

Microscopic examination:

Epithelial cells: nil
Pus cells: 1-3/HJ'F
RBGs: 20-30 /HPF
Crysta1s: Nil
Casts: RBC cast

glomerulonephritis

Physical examination:

Volume: 200 cc. (random sample)

Co lour: Amber Yellow

Reaction: Acidic

Specific gravity: 1025

Aspect: turbid

Chemical examination:

Alb: ++++

Sugar: Nil

Acetone: Ni1

Bile pigments: Nil

Urobi1inogin: Normal trace

Microscopic examination:

Epithelial cells: nil

Pus cells: 1-3/HJ'F

RBGs: 1-2 /HPF

Crysta1s: Nil

Casts: nil

What we need next?

Physical examination:

Volume: 200 cc. (random sample)
Co lour: Amber Yellow
Reaction: Acidic
Specific gravity: 1025
Aspect: turbid

Chemical examination:

Alb: ++++
Sugar: Nil
Acetone: Ni1
Bile pigments: Nil
Urobi1inogin: Normal trace

Microscopic examination:

Epithelial cells: nil
Pus cells: 1-3/HJ'F
RBGs: 1-2 /HPF
Crysta1s: Nil
Casts: nil

What we need next? 24 h urinary protein.

Physical examination:

Volume: 200 cc. (random sample)
Co lour: Amber Yellow
Reaction: Acidic
Specific gravity: 1025
Aspect: turbid

Chemical examination:

Alb: ++++
Sugar: Nil
Acetone: Ni1
Bile pigments: Nil
Urobi1inogin: Normal trace

Microscopic examination:

Epithelial cells: nil
Pus cells: 1-3/HJ'F
RBGs: 1-2 /HPF
Crysta1s: Nil
Casts: nil

What is your diagnosis?

Nephrotic syndrome

24h urinary protein 4 gm

Thank You